Energy, Transportation, and Mission

Energy is an essential resource for Fort Carson's training and deployment missions, and its availability and cost affect the quality of life for soldiers and families. Energy sources at Fort Carson are primarily non-renewable; therefore availability will decrease over the long-term. Inefficient energy use increases operational cost, and increases environmental degradation from resource extraction, climate change, and air pollution.

The installation consumes energy through building operation and transportation. These include such activities as building heating and cooling, lighting, water heating, facility operation, transportation of fuel, fueling, and vehicle usage. The impacts are numerous—CO, CO_2, NO_x, benzene, VOCs, toluene, carbonyls, hydrocarbons, SO_x, lead, cadmium, mercury, and potential oil leaks and spills. The installation's influence on energy usage and air quality should not be underestimated. It is significant.

By changing the installation's energy consumption choices, Fort Carson can significantly decrease its operational cost, promote better regional air quality, and avoid mission restrictions in the future. Through energy conservation measures, green design, alternative fuels and technologies, the potential for cost-savings and a healthier atmosphere is enormous.

Rocky Mountain Institute's <u>Green Development</u> Approach:

"Amory Lovins, cofounder and research director of Rocky Mountain Institute, coined the phrase to guide decision-making in the energy industry. People don't want electricity or oil or coal; what they want are the services energy provides: illumination, cold beer, comfortable living rooms, hot showers, and so on. How can we provide these services, he asked, with the least overall cost? Lovins concluded that building multi-billion-dollar nuclear power plants to operate baseboard heaters in drafty houses was not a least-cost solution to keeping people comfortable. Why not insulate the houses–for perhaps a hundredth of the financial and environmental cost–or build them right in the first place?"

Rocky Mountain Institute. 1998. <u>Green Development: Integrating Ecology and Real Estate,</u> John Wiley and Sons, Inc., New York, NY.

Key Facts

Cost Figures – FY01	Other Figures – FY01
Electricity: $5.7 million	**Average Fort Carson Commute: 12,750 miles/yr/person**
Natural Gas: $6.9 million	**CO_2 Emissions: 27,410 tons**
Gasoline: $40,000	**NO_x Emissions: 753 tons**
Diesel Distillate: $130,000	**Mercury, Cadmium, and Lead Emissions: .38 tons**
Tactical Fuel: $1.4 million	

Key Sustainability Considerations

Energy Conservation – Many opportunities for reducing energy consumption in existing facilities and operations are available. Fort Carson needs to find the financial resources to invest in these opportunities and the management time to initiate and manage retrofit projects.

New Construction – Significant new construction is underway on Fort Carson. The energy consumed in new facilities will likely remain relatively constant over the 50+ years these buildings are in operation. New buildings can be designed to be substantially more efficient than most buildings constructed today, and more efficient than the inventory of buildings now on Fort Carson. Given the lifetime of new facilities, and the difficulty in radically improving energy efficiency in buildings after construction, energy efficiency of all new Fort Carson facilities represents an enormous opportunity. Over the next two years, Fort Carson plans to spend over $140 million on new military construction, and build three child development centers and a car care center.

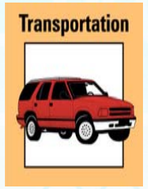
Energy Independence – Future energy costs will fluctuate to an even greater degree given recent deregulation of the gas and electricity markets. On-site generation of electricity from renewable sources (e.g., solar and wind) would help stabilize energy costs and improve energy supply reliability. Use of distributed energy sources (e.g., renewable energy and small, distributed generators such as micro turbines and fuel cells) can help ensure a reliable energy supply.

Community Pattern Transportation – Air pollution is a function of miles traveled and vehicle use. Commuting options that minimize vehicle use can reduce regional pollution due to transportation.

Fuel Efficiency – The types of vehicles used in commuting and mission activities directly impacts air quality. Fuel-efficient vehicles create less pollution.

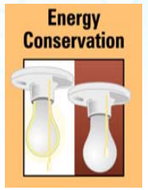
Alternative Technologies – Alternative fuels and new motors can reduce petroleum fuel consumption.

Realm of Possibilities

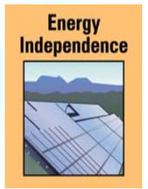


- **Trees for Travel:** Trees for Travel is an organization that will plant trees to offset the pollutants caused by air and vehicle travel. Organizations can keep track of their mileage and send donations to Trees for Travel; or, large land-owning organizations, such as Fort Carson, can start their own program to offset the vehicle emissions caused by transportation activities.

- **Fuel Cell Vehicles/AFVs:** Alternatively fueled vehicles (AFVs) are available on a limited basis now, but it will be a few more years before they truly begin to capture market share in the public and private sectors. Honda is working on a zero emission vehicle that uses fuel cells for power. The state of California will now give up to $9,000 in rebates to people who buy super-low emission vehicles (SuLEVs). Fleets, especially buses, are prime candidates for alternative fuels, such as compressed natural gas, with lower per mile costs associated with the fueling of larger fleets.



- **Energy-saving Technologies:** There are a variety of technologies that can reduce the amount of energy used in buildings. Such systems can be integrated into existing buildings during renovations and updates. Such technologies include:
  - ~ **Microscopic Energy Systems:** Scientists at PNNL and other research laboratories are developing a family of micro-sized energy systems that are manufactured in much the same way that computer chips are made. Microscopic heat exchangers, evaporators, condensers, gas absorbers, turbines, bioreactors, chemical reactors, chemical separators, pumps, and valves exhibit extraordinary rates of heat and mass transfer.
  - ~ **Drain Water Heat Recovery:** It is estimated that up to 80 percent of residential water-heating bills come from shower/bath water. An innovative technology called drain water heat recovery uses the latent heat in drain water to "preheat" cold water before it is sent through a conventional water heater.
  - ~ **Superconductivity:** Superconductivity, the ability of a material to conduct electricity with zero resistance and almost no loss of power, is a cutting edge technology that may some day revolutionize the way we think about electricity (http://www.eren.doe.gov/superconductivity/). Today, almost 10 percent of all electricity generated is lost in transmission, radiated as heat from inefficient copper and aluminum wires.
  - ~ **Spectrally Selective Windows:** The next generation of windows will be so-called "spectrally selective" and chromogenic windows. Spectrally selective windows have advanced coatings that filter certain wavelengths of radiation from the incident sunlight, significantly lowering the overall solar heat gain.



- **Intelligent Buildings:** The intelligent building is the future of architecture. It looks like any other building from the outside, but employs sophisticated control systems to make building systems (e.g., heating, cooling, ventilation, lights, windows, and appliances) more convenient and efficient. Commercial office buildings are being designed wherein lighting, temperature, and humidity in the space occupied by each worker are regulated according to his/her preferences, and windows automatically darken to provide appropriate ambient lighting for the task at hand.

- **Photovoltaics:** Solar panels have the potential to provide a significant amount of the nation's electricity supply. *The theoretical potential of PV on rooftops alone could satisfy up to one-third of world electricity demand.* However, they are expensive to manufacture, have not yet realized their efficiency potential, and take up lots of room. This situation is starting to change with current improvements in overall system efficiency. New products that integrate photovoltaic cells into building materials are now entering the market. Skylights, awnings, wall panels, and roof shingles now incorporate PV, generating electricity while serving a second structural function.

- **Wind Power:** Wind has been the fastest growing source of electricity generation in the world through the 1990s. However, the majority of this growth has been in Europe, where conventional energy costs are higher than those in the U.S. With large, untapped, wind energy resources throughout the country and declining wind energy costs, the U.S. is now moving forward into the 21st century with an aggressive initiative to accelerate the progress of wind technology and further reduce its costs, to create new jobs, and to improve environmental quality.

- **Bio-fuels:** Bio-fuels are alcohols, ethers, and other chemicals made from renewable resources (e.g., fast growing trees, grasses, and algae) and waste products (e.g., agricultural and forestry residues, and municipal and industrial wastes). It is estimated that domestically produced biomass resources could eventually provide at least half of the U.S. light duty vehicle (LDV) fuel requirement. Bio-diesel fuels are available today from the Defense Energy Supply Center for use in non-tactical vehicles. In the not-too-distant future, biomass will be consumed in fuel cells in vehicles and stationary equipment to produce heat and electricity very efficiently, with virtually no pollution and no net increase in carbon emissions.

Energy and Transportation

Challenge: Secure reliable, affordable energy for training and deployment missions, and quality of life. How can Fort Carson…

- ➢ Reduce the cost amount and cost volatility of energy available to facilities and fortransportation? Improve the reliability of the energy supply?
- ➢ Reduce the environmental impacts of energy use from facilities and vehicles?
- ➢ Site and design buildings and developed areas to reduce construction and operating/maintenance costs?
- ➢ Site and design buildings and developed areas that reduce environmental impacts and energy requirements?
- ➢ Create an Installation that enhances quality of life for those living and working there?